

**AN ARTIFICIAL UNDERWATER MEMORIALIZING CATAcomb AND REEF SYSTEM**

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BACKGROUND OF THE INVENTION

1. Field of the Invention

10 This invention relates generally to an artificial underwater catacomb and modular reef made of discrete, interlocking modules manufactured using concrete forms. A module or catacomb section can contain one or more urns for memorializing a person and providing an evocative environment for a visitor either diving or 15 snorkeling. The invention also relates to a rapid and efficient method for manufacturing and installing the artificial underwater catacomb.

2. Description of Related Art

20 Artificial reefs are generally known for preventing or controlling beach erosion, as well as providing environmentally compatible structures for attracting marine life, and fostering aquatic habitats. These reefs are used for the both greater enjoyment of coastal recreation by preserving sandy beaches and 25 minimizing expensive and difficult reclamation projects, and in other applications to provide structure for underwater recreation by simulating a natural reef, with fish, coral, plant life, and

other aquatic life forms which develop about the artificial structure.

Also, the combination of burial at sea and the cremation of human remains have been known since the tradition of the Vikings 5 funerals, wherein the deceased was placed in a burning boat. Moreover, the burial at sea of human cremated remains is also known in modern times. In U.S. Patent No. 3,732,602 to Vigh, human cremated remains are placed in biodegradable urns, so the deceased eventually is washed away into the sea.

10 In U.S. Patent No. 6,189,188 to O'Hare, a memorial in the form of an artificial reef is taught which consist of modular units. The units incorporate human remains into a cement mixture, so the units together provide a memorial in a marine environment. In O'Hare, the remains are mixed into cement mixtures to be 15 poured into receptacles in the reef forms.

While O'Hare provides a reef that acts as a memorial for human remains, O'Hare does not teach the construction of catacombs, which are an attraction for both divers and marine life, and which evoke an emotional reaction in underwater 20 visitors. O'Hare also does not teach underwater tunnels or enclosed spaces accessible to underwater visitors. Moreover, O'Hare does not teach the use of urns that are provided with the remains. If the bereaved uses the remains in O'Hare, or otherwise scatters the remains, then the urn will remain as an unnecessary

and inappropriate memorial. Furthermore, O'Hare does not teach a rapid and efficient method for creating an artificial catacomb.

Consequently, a need exists for the use of the remains together with the urn in a memorial that is appropriate for 5 someone who loved the sea. A need also exists for the creation of a catacomb, which would be attractive to visitors to the remains as well as visitors to a marine environment. Also, the need exists for a creation of an evocative underwater structure so the visitors and divers are moved toward an appreciation for the 10 number of people who loved the sea and for our rapidly disappearing marine resources. Underwater tunnels, passageways and enclosed spaces are also needed to heighten the experience for an underwater visitor, and uniquely combine the salient features of personal memorial, artificial reef, and catacomb 15 system. Also, a need exists for an efficient and rapid method for creating the catacomb to keep costs of construction as low as possible.

Moreover, current reef module designs are not optimized for several different types of flora and fauna found in different 20 areas of sea floor.

Also, current marine habitat modules can be unsafe and tumble at relatively shallow depths. The preferred embodiment of the module has shown to be stable at depths of approximately 40 feet on the east coast of Florida and at depths of approximately 25 30 feet or deeper on the west coast.

THEREFORE, an important object of the invention is to provide an interesting and appropriate resting place for the remains of a person and the urn commonly used for containing the remains into a module which forms the basis of a structure which 5 is attractive to divers and marine wildlife.

Another object is to provide underwater passageways, enclosed spaces, catacombs and mazes that are ornamentally pleasing and evocative to divers and snorkelers.

It is also an object of this invention to provide a 10 interesting theme park habitat attractive to marine wildlife and marine enthusiasts alike.

It is also an object of this invention to provide a unique maze of intersecting passageways to amplify the wonder felt by a diver or snorkeler inside a passageway.

15 It is also an object of this invention to provide a single module which is optimized for use in various different environments.

It is also an object of the invention which is stable at depths of approximately 40 feet on the east coast of Florida and 20 at depths of approximately 30 feet or deeper on the west coast.

BRIEF SUMMARY OF THE INVENTION

The present invention provides an appropriate use for the remains and urn of a loved one, whether a person or a pet, a respected member of society, or simply someone who loved the sea.

5 The present invention also creates an underwater catacomb attractive to all types of visitors. In one embodiment the artificial reef system includes arched passageways, with unique ingress and egress portals, while simultaneously incorporating the memorial urn in select reef modules. The catacomb is  
10 evocative, so that visitors become more appreciative of those who love the sea and of our rapidly diminishing marine resources. The underwater system can portray visually stimulating designs, which could be viewed from glass bottom boats. The catacomb also includes tunnels and enclosed areas accessible to snorkelers and  
15 scuba divers. The present invention also provides an efficient and rapid method for creating the catacomb. The present invention also provides an evocative underwater theme park and attraction, which includes the feature of a conventional memorial.

In one embodiment, the present invention is an artificial  
20 underwater catacomb for memorializing a person and providing an evocative environment for a visitor, including one or more urns containing cremated remains imbedded at least partway within a plurality of concrete modules, which constitute discrete pieces manufactured using concrete forms. The concrete modules are  
25 interlocking, and can be stacked to form structural support,

columns or end caps for the catacomb. The modules also can be assembled to construct the walls, tunnels or passageways, ceilings, arches or portals for the submerged ducts. More than one urn may be imbedded in each concrete module or segment. The 5 module can be marked to indicate the identity of the remains within the imbedded urn. In another embodiment, the catacomb includes tunnels that branch into an enclosed underwater area or maze.

In another embodiment, the invention is a concrete article 10 comprising a concrete segment and at least one cavity therein containing at least partway an urn containing cremated remains. The article comprises a shape whereby it can be interlocked with an adjacent piece or stacked with other articles to form an underwater structure, such as a catacomb with tunnels and nooks. 15 The articles can be planar or curved, and of varying dimensions. Any particular tunnel section can include various portals, such that a diver can enter and leave the catacomb at different locations. This design also facilitates the development of aquatic life, and the creation of unique, visually stimulating 20 artificial reefs with theme park-like features.

The system allows for the specific identification and 25 location of modules, to memorialize loved-ones. For example, a tunnel section can be dedicated to veterans, or a particular battalion or branch of the armed services. These modules would contain urns, and could also incorporate an insignia, logo, or

epitaph on the external surface of that section. In still another embodiment, the invention is a rapid, cost effective and efficient method for creating an artificial underwater catacomb comprising the steps of mixing concrete or a cement mixture, 5 placing one or more concrete molds for interlocking and stacking forms on a floating vessel, and pouring the mixture into one or more concrete molds. One or more urns contains cremated remains, and is interposed at least partway within one or more concrete molds before the mixture sets, thereby forming one or more 10 concrete modules when the mixture sets. If desired, an urn can be completely imbedded into any module. Thereafter, allow the mixture to set and placing the concrete forms underwater in a stacked or interlocking orientation thereby forming an underwater catacomb. In yet another embodiment, the step of placing the 15 concrete forms includes lowering the concrete forms in place with a gantry system aboard the floating vessel.

Also it is an object of the invention to provide a module for the reduction of beach erosion and the provision of a marine habitat. The module is optimized for a variety of marine 20 locations, considering the geography, hydrology and marine life of various locations.

It is another object of the invention to provide a module whereby a reinforcing bar cage provides the dual purpose of reinforcing the module and separating urns placed within the 25 module.

In accordance with these and other objects which will become apparent hereinafter, the instant invention will now be described with particular reference to the accompanying drawings.

5 BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Figure 1 is a cross-sectional view of the preferred embodiment of the invention.

Figure 2 is a top plan view of the preferred embodiment of a module of the invention.

10 Figure 3 is a perspective view of the invention as it is interlocked horizontally.

Figure 4 is an end view of a tunnel in the preferred embodiment of the invention.

15 Figure 5 is a perspective view of an intersection of tunnels in the preferred embodiment of the invention.

Figure 6 is a perspective view of the interrelated catacomb sections, maze, and portals of a selected area in the preferred method of the invention.

20 Figure 7 is a perspective view of an alternative embodiment of the invention.

Figure 8 is a perspective view of the preferred embodiment of the method of the invention.

Figure 9 is a perspective view of an alternative embodiment to the invention.

Figure 10 is a side elevation view of an alternative embodiment of the invention.

Figure 11 is an end elevation view of an alternative embodiment of the invention.

5 Figure 12 is a perspective view of an alternative embodiment of the invention.

Figure 13 is a top plan view of an alternative embodiment of the invention.

Figure 14 is a cutaway side elevation view of the base 10 portion and middle portion of an alternative embodiment of the invention.

Figure 15 is a cutaway top plan view of the base portion and middle portion of an alternative embodiment of the invention.

Figure 16 is an end view of an alternative embodiment of the 15 invention.

#### DETAILED DESCRIPTION OF THE INVENTION

The present invention is a concrete module shown in Figures 1 and 2 and described generally at 10. The module 10 is made from known formulations of concrete mixture suitable for the creation 20 of underwater structures generally known in the construction industry. The concrete mixture when prepared to the appropriate consistency is poured into a form 12 to create a medium 14 into which an urn 16 containing cremated remains 62 is placed. The remains can be human or that of a beloved pet. The urn 16 is 25 placed within the medium 14 before the medium 14 fully hardens.

The urn 16 is thus at least partway permanently imbedded within the concrete medium 14. In the preferred embodiment, the urn 16 is entirely encased within the concrete medium 14. Once the medium 14 is set, the urn 16 is permanently encased in the medium 5 14, and the catacomb segment or piece 10 is created. In an alternative embodiment, the external surface of module 10 is marked to identify the remains 62 located therein. The marking may be a name chiseled into the form, a plaque, an epitaph, a logo, or similar inscription.

10 The module 10 preferably has an interlocking configuration, as shown in Figures 2 through 6. In the preferred embodiment, the interlocking configuration includes one or more horizontal protrusions 18 and one or more peripheral recesses 20. The surfaces are generally smooth, rounded and have consistent 15 transitions to facilitate positioning and construction of catacomb sections. It is important that the concrete forms and molds have precise corresponding components and mating sections for simplifying installation. Furthermore, as illustrated in Figure 5, the modules may be interlockingly and vertically 20 stacked. Through curvature of the modules 10, vertical stacking can transform into horizontal interlock, thereby forming arches, passageways, enclosed spaces, catacombs and/or mazes.

In an alternative embodiment, the module 10 has a stackable configuration. In this embodiment, as shown in Figures 1 and 7, 25 the module 10 includes one or more vertical protrusions 22 and

one or more vertical dentations 24. Although Figure 1 illustrates the vertical dentation 24 on the top portion 26 of the module 10 and the vertical protrusion 22 on the bottom portion 28 of the module 10, the vertical dentation 24 and the vertical protrusion 5 22 alternatively may be flipped on the module 10. Furthermore, Figures 1 and 5 illustrate the use of a curvature in the modules 10 to form arches, passageways, enclosed spaces, catacombs and/or mazes. Figure 7 illustrates another embodiment in which the vertical dentations 24 and vertical protrusions 22 allow the 10 modules 10 to be stacked to form an underwater catacomb 36 with one or more nooks 38 and tunnels 40. Although in Figure 7 the modules 10 are shown stacked precisely one on top of the other, the protrusions 22 and the dentations 24 may allow the modules 10 to be stacked in an offset orientation. The catacomb 36 provides 15 an ornamentally pleasing, interesting and evocative environment for a visitor 42 while simultaneously providing a memorial to the deceased person whose remains are embedded in the catacomb segment. As mentioned, an entire section or wing of the maze may be dedicated to a particular group or military division, to 20 commemorate extraordinary achievement or honor. For example, a wall could be reserved for those who gave their life in a particular battle, such as Pearl Harbor or the Gulf War, the latter representing a more recent conflict in American history.

Figure 4 illustrates a preferred embodiment of the 25 invention, wherein a plurality of modules 10 form a tunnel

entrance. The modules 10 are interlocking by their corresponding protrusions 18 and recesses 20. As shown, several catacomb segments are used to create a tunnel 50. The tunnel 50 is of sufficient size to allow a visitor to pass through its interior

5 54. Both vertical and horizontal pieces are utilized, along with curved pieces to complete arches and transition sections. Alternatively, a passageway may also be created by stacking one or more layers of pieces to create the tunnel 50, or to provide support in the form of a column or end unit. Also, the shape of

10 the tunnel 50 may be of generally rounder or flatter curvature than that illustrated in Figures 4 and 5. As understood to one of ordinary skill in the art, the concrete pieces of the instant invention can be utilized to create a variety of different shapes and structures.

15 In another embodiment, shown in Figure 9, one or more truss assemblies 62 is first is constructed on the seabed. Preferably, this assembly 62 includes dentations 64 for the placement of the modules 10 which are generally slab-shaped and which have projections 66. As shown, the modules 10 may then be placed

20 across the sloped sides 68 of the assembly 62 as well as across the top 70 of the assembly 62. Although a horizontal top 70 of the assembly 62 is shown, other geometric shapes, such as an arc or an entire enclosed area, are also contemplated for the top 70 of the assembly 62. Also, other shapes for the modules 10, such

25 as curves or angles, are also contemplated. As shown, the modules

10 include projections 66 for complementary joining with the  
dentations 64 on the assembly 62. However, other means for  
joining the modules 10 with the assembly 62, such as a pin and  
eye connection, or having the projections on the assembly 62 and  
5 dentations on the modules 10, are also contemplated. Assemblies  
62 may also be connected to one another to form the framework for  
tunnels, enclosed areas, catacombs and other underwater  
structures as modules 10 are attached to the assemblies 62.

Figure 5 illustrates how a plurality of tunnels 50 may  
10 intersect at an intersection point 52. Separate passageways thus  
may branch off from one another, creating a more interesting  
experience for a diver exploring the tunnels' interiors 54. More  
than one intersection point 52 may exist in each catacomb 36.  
15 Further, the overall system can be designed to achieve a specific  
"look from above" for the enjoyment of those viewing the overall  
system from the vantage point of a glass bottom boat, or the  
like. Examples include a Crucifix, Star of David, or Army  
insignia, amongst innumerable others.

Also, as shown in Figure 6, the preferred embodiment of the  
20 invention comprises an underwater enclosed space 56. The  
interior of the enclosed space 56 is accessible to divers by the  
adjacent tunnels 50. In this sense, the catacomb system provides  
a series of unique caves and exotic passageways for exploration.  
As the marine habitat is enhanced over time with a variety of  
25 aquatic life, the effects can be dramatic. Any particular segment

can incorporate unique entrances within the maze, providing dissimilar areas of reef sections.

Alternatively, the enclosed space 56 may be accessed through one or more intermediate openings 59. Tunnels 50 branching from 5 the enclosed area 56 may also have intermediate openings 60 for divers.

It is preferred that the catacomb 36 be created as rapidly and efficiently as possible. In the preferred embodiment of the method of creation of the catacomb 36, a floating vessel 44 is 10 used to carry the molds 12 for interlocking and/or stacking concrete modules 10. The vessel 44 may be powered or transported with the assistance of a barge or tug boat. Preferably, the vessel 44 has a gantry 46 or other means for accurately placing the concrete modules 10.

15 A concrete forming mixture 14 is intermixed and poured into the forms 12. One or more urns 16 containing cremated remains 62 are then interposed in each form 12 at least partway within the mixture 14. Once the mixture 14 sets, the discrete concrete modules 10 are created. The forms 12 are designed to have 20 compatible and mating sections and surfaces, such that different pieces interlock with one another. Many shapes can be utilized for curved sections, to ease installation and transition areas.

The gantry 44 is then used to lower the concrete modules 10 underwater and to place the concrete modules 10 in an 25 interlocking, and/or stacked orientation forming an underwater

catacomb 36 with nooks 38, tunnels 40 and one or more enclosed areas 60.

Once the catacomb 36 has been constructed, the environment it provides will have an emotional impact on visitors 42. The 5 shape of the catacomb 36 and the presence of cremated remains within the structure combine to evoke emotional responses on many levels from visitors 42. The unique combination of an underwater theme park, artificial reef, catacomb system and memorial creates an ambiance heretofore unparalleled. The tunnels and enclosed 10 areas will provide added interest to visitors, thereby creating underwater attraction. The impact will be heightened when a large number of urns 16 are used in the creation of the catacomb 36. Enhancing the passageways with inscriptions and logos provides substantial emphasis on the tribute to others. The 15 impact will also be heightened for the visitor 42 as more marine creatures use the catacomb 36 as a feeding ground or shelter.

In another embodiment, a single module is formed which reduces beach erosion and which provides a marine habitat. This embodiment is illustrated as 100 in Figure 10 through 12. As 20 shown, the module 100 includes a generally slab-shaped base portion 102 or other means for anchoring and/or contacting the module to the sea floor. Located above the base portion 102 is a generally tabular middle portion 104. Located above the middle portion 104 is an upwardly sloping upper portion 106. It is 25 preferred that the upper portion has a void, more clearly shown

at 108 in Figure 13. the void 108 provides a means for entering the upper portion. The middle portion 104 is a means for providing a flange 110 overhanging the base portion 102. Some types of marine fauna prefer an overhang in its environment.

5 Although a squarish embodiment is illustrated, other shapes, such as five or more sides, rounded, round, triangular, kidney-shaped, irregular shapes or other known shapes are contemplated herein.

The upper portion 106 preferably includes one or more voids 112 through at least one side 114 of the upper portion 106. It is 10 preferred that the sides 114 are upwardly sloping. The voids 112 are preferably formed after a pour of material into a form for the upper portion. It is preferred that the voids are approximately 8 inches to one foot in diameter. The voids may alternatively be made during the formation of the upper portion 15 106 using means such as a PVC pipe form.

One example of the invention showing reinforcement bars 116 is shown in Figures 14 and 15. It is preferred that the module 100 include reinforcement bars 116, and the preferred reinforcement bars 116 are made from epoxy coated steel or 20 regular steel rebar. The bars preferably run through the base portion 102 and into the middle portion 104, and, as described below, into the upper portion 106. As shown, the reinforcement bars 116 comprise a single framework 118, which is preferred to be in the shape of a web, or cage 118.

In an alternative embodiment of the invention, the cage 118 provides a means for separating urns 120 located within the base portion 102 of the module 100. The urns 120 are preferably within at least a portion of the cage 118. Alternatively, urns 120 may 5 be placed within the base portion without the use of the cage 118. Reinforcement bars are also preferably placed within the top portion 106 of the module. It is preferred that the reinforcement bars of the top module 106 are tied to those in the middle portion 104 and/or base portion 102. Urns may be made of metal, 10 plastic, concrete, wood or equivalent material.

In another embodiment, shown in Figure 10, means for lifting the module, such as eyehooks 122, are attached to the module 100. Other means for lifting and moving the modules are known in the art and are contemplated herein.

15 After the formation of the basic module 100, as shown in Figure 16, it may be preferred to attach coral attachment areas 124 are attached to at least a portion of the top surface 126 of the middle portion 104. The coral attachment areas 124 are preferably also attached to an outer surface 128 of the upper 20 portion 106. Preferably, the coral attachment areas comprise limestone boulders or equivalent materials.

Alternatively, legs may also be attached to the bottom or sides of the base portion 102.

The preferred method for forming the module 100 is as 25 follows. A tabular form for the pouring of concrete is provided.

A web or cage of reinforcing bars is formed and placed within the tabular form. A cage which is six bars by four bars is preferred. Urns, if desired, are placed at least partially within the reinforcing bars. Thus the reinforcing bars serve the dual 5 purpose of reinforcing the module and separating the urns placed within the base portion. The urns may be made of concrete, metal or other suitable material. Wire ties may be used to suspend the urns within the form during the formation of the base unit. Eye hooks for lifting the module may be placed on the top surface of 10 the middle portion if desired. Concrete is then poured within the form to form a base portion and a middle portion. Urns, if placed in to the base, are then secured into the base by the poured concrete. The ties may then be removed when the concrete has partially set.

15 After the base portion and the middle portion have set, a top form is then placed on the middle portion for a top portion of the module. The form may be made from Styrofoam, wood, or other suitable material known in the art. Reinforcing bars, if desired, may be placed within the top form. It is preferred that 20 at least two bars are used horizontally around the middle of the top portion. The reinforcing bars in the top portion are preferably tied to the bars in the cage, and, like those bars, are preferably epoxy coated, but may also be material such as steel rebar. Four bars preferably extend upwards on long sides of

the module, and three bars extend from the short sides. However, other geometry such as a longer rectangle or square may be used.

Concrete is then poured into the top form, thereby forming the top portion of the module. It is preferred that the form 5 provides a void or cavity in the top of the upper portion extending into the interior of the upper portion. After the module is formed, holes are provided through the sides of the upper portion. After the module has fully set, coral attachment areas are attached to the module.

10 The preferred concrete material for the modules is a ready mix concrete or batch concrete. The preferred approximate base dimensions are two feet high, four feet wide and six feet long. The middle section is preferably approximately 6.5 - 8 feet by 8.5 - 10 feet, with a thickness of approximately four to seven 15 inches. Thus, the preferred overhanging ledge is approximately 18 inches wide. The upper section is approximately four feet by six feet at the base, and tapering upwards to approximately two feet by three feet. Three holes are preferably drilled in the long sides, and two holes are preferably drilled in the short sides.

20 The holes are preferably eight inches to one foot in diameter. The placement of the holes is preferred to avoid any reinforcing bars that may be within the upper portion. The thickness of the upper portion is preferably approximately four to seven inches. More holes and smaller or larger holes are also contemplated by 25 this invention.

Generally, the curing time for the module itself is approximately 30 days. The modules are preferably placed approximately 10 feet apart.

The instant invention has been shown and described herein in 5 what is considered to be the most practical and preferred embodiment. It is recognized, however, that departures may be made therefrom within the scope of the invention and that obvious modifications will occur to a person skilled in the art.